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STATE OF ILLINOIS
DEPARTMENT OF REGISTRATION AND EDUCATION

MINERAL RESOURCES AND MINERAL INDUSTRIES OF THE WESTERN ILLINOIS REGION

Robert L. Major

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ABSTRACT

The mineral resources, primary mineral producing operations, and mineral processing facilities in the Western Illinois Region are located and described in this report. The region includes the 13 counties that compose the central western portion of the state of Illinois—Adams, Brown, Calhoun, Fulton, Hancock, Henderson, Henry, Knox, McDonough, Mercer, Pike, Schuyler, and Warren.

Value of mineral production in 1965 was $56.0 million. The minerals and mineral products produced in this region were coal, clay products, lime, crushed and broken stone, gravel, sand, and crude oil. In addition, the Western Illinois Region possesses undeveloped mineral resources such as oil shale, feldspar-bearing sands, and pyrite. Processing facilities are quite limited, consisting of two lime plants and two small crude oil refineries. The region is served by several oil and gas pipelines.

INTRODUCTION

This report is the sixth in a series of eight concerning Illinois mineral resources and related mineral industries. The series is prepared by the Mineral Economics Group, with the assistance of staff members in other sections of the Illinois State Geological Survey. All production statistics used, unless otherwise noted, are based on the annual reports on Illinois mineral production published by the Survey. This report covers the Western Illinois Region, which comprises the 13 counties in the western part of the state lying for the most part between the Illinois and Mississippi Rivers: Adams, Brown, Calhoun, Fulton, Hancock, Henderson, Henry, Knox, McDonough, Mercer, Pike, Schuyler, and Warren (fig. 1).

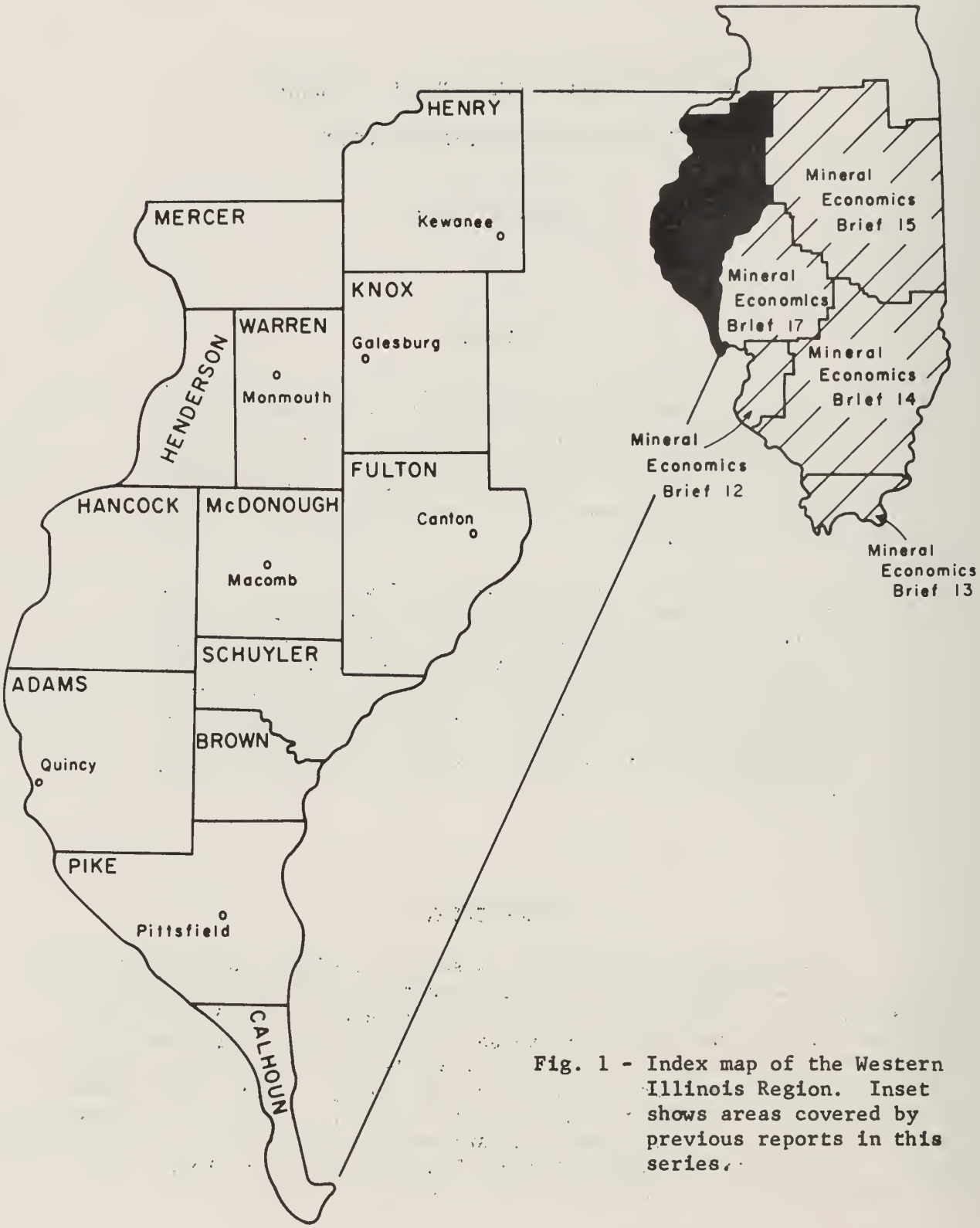

Fig. 1 - Index map of the Western Illinois Region. Inset shows areas covered by previous reports in this series.

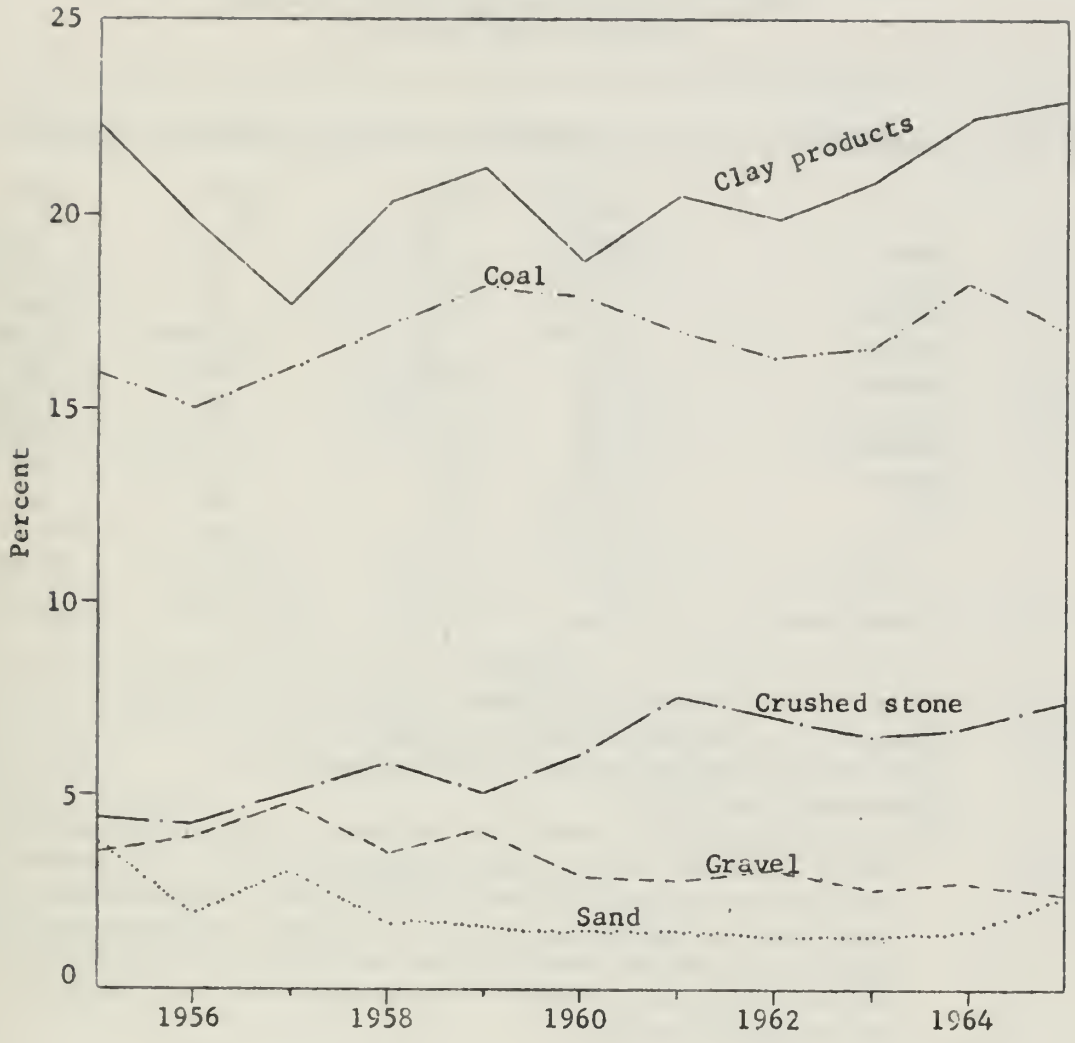

Fig. 2 - Western Illinois Region's mineral production as a percentage of the total Illinois mineral production for that commodity. (Oil production has been so small that it cannot be shown on this scale; data on lime must be concealed to keep individual company information confidential.)

The relative importance of this region as a producer of various mineral commodities from 1955 to 1965 is shown in figure 2. During this period the Western Illinois Region produced, on the average, 21 percent of the state's clay products, 17 percent of the coal, 6 percent of the stone, 3 percent of the gravel, 2 percent of the sand, and 0.1 percent of the crude oil. In addition, the region produced smaller amounts of lime and natural bonded molding sand. The size of the payroll and the number of employees dependent upon the mineral industries in many of the counties of the Western Illinois Region are shown in table 1.

TABLE 1 - EMPLOYMENT AND PAYROLL OF THE MINERAL INDUSTRIES IN SELECTED COUNTIES IN THE WESTERN ILLINOIS REGION IN 1958* AND 1963†

County	Employees		Payroll (in $1000)	
	1958	1963	1958	1963
Adams	126	127	523	632
Brown	16	NA°	53	NA°
Calhoun	11	NA	20	NA
Fulton	805**	984	5,017**	7,392
Henderson	55	NA	215	NA
Henry	63	182	258	1,213
McDonough	63	NA	216	NA
Mercer	24	NA	107	NA
Pike	58	NA	227	NA
Total‡	1,221	1,293	$6,636	$9,237
State total	27,482	22,675	$144,359	$138,394

*Source: U. S. Bureau of the Census, 1961, p. 10-9 to 10-12
†Source: U. S. Bureau of the Census, 1966, p. 12-7 to 12-10
°Data not available in Census of Mineral Industries.
**Bituminous coal only.
‡Data not available for either year for Hancock, Knox, Schuyler, and Warren Counties. In 1965 Hancock County had four stone quarries in operation and produced some crude oil; Knox County had two coal mines, one stone quarry, two clay products plants, and one gravel pit; Schuyler County had one coal mine, two stone quarries, and one sand pit; and Warren County had two stone quarries and one clay products plant.

The value of mineral production for the region (table 2) was $55.0 million in 1964 and $56.0 million in 1965, or 8.9 percent and 9.1 percent, respectively, of the state total for each of the two years. The mineral commodities produced, in order of their 1965 value, were coal, clay products, crushed and broken stone, gravel, sand, and crude oil.

Each of the commodities is discussed in terms of resources, past and present production, and the extent of mineral producing and processing facilities. Undeveloped minerals of potential importance in the Western Illinois Region also are considered.

COAL

Illinois is abundantly endowed with coal resources. The commercial coals of Illinois were formed during the Pennsylvanian Period. A detailed

TABLE 2 - MINERAL PRODUCTION IN 1964 AND 1965
FOR THE WESTERN ILLINOIS REGION

Commodity	Quantity	Value	No. of operations	Average value
		1964		
Coal (tons)	10,011,306	$37,942,849	19	$3.79/ton
Clay products	---	11,531,453	8	---
Stone (tons) (crushed & broken)	2,641,293	4,004,495	32	1.52/ton
Gravel (tons)	457,000	597,000	8	1.31/ton
Sand (tons)	222,000	184,000	8	0.83/ton
Crude oil (barrels)	59,000	172,870	---	2.93/bbl
Other materials*	---	612,648	3	---
Total		$55,045,315		
		1965		
Coal (tons)	10,041,792	$37,556,302	16	$3.74/ton
Clay products	---	12,043,219	9	---
Stone (tons) (crushed & broken)	3,232,572	4,538,849	30	1.40/ton
Gravel (tons)	462,000	570,000	7	1.23/ton
Sand (tons)	323,000	264,000	10	0.82/ton
Crude oil (barrels)	54,000	158,220	---	2.93/bbl
Other materials*	---	854,862	3	---
Total		$55,985,452		

*Includes lime and natural bonded molding sand.

assessment and classification of coal reserves in the state was begun in 1950 under the direction of Gilbert H. Cady, then Head of the Coal Section of the Illinois State Geological Survey. The results were published by the Geological Survey in 1952 as Bulletin 78 (Cady and others, 1952). Reserve estimates for 20 coals were made and grouped into four categories—proved, probable, strongly indicated, and weakly indicated. These reserve categories are defined in terms of the reliability of the data. All coals less than 28 inches thick were excluded. Total estimated reserves of all classes in Illinois amounted to more than 137 billion tons of coal in the ground, of which 61 billion tons were included in the two most reliable classes.

No attempt was made in Bulletin 78 to differentiate between strippable and underground reserves. Therefore, in 1957, a new study was begun to evaluate the strippable coal reserves in Illinois. The state was

divided into nine resource regions, and by the end of 1964 reports on five of these had been completed. The results have been published as Illinois State Geological Survey Circulars 228, 260, 311, 348, and 374 (Smith, 1957, 1958, 1961; Smith and Berggren, 1963; Reinertsen, 1964). In these reports the extent of strippable coals at various depths of overburden (0 to 50 feet, 50 to 100 feet, and 100 to 150 feet) and for varying degrees of reliability of data (Class I - Primary Reserves; Class II - Secondary Reserves) was determined. Coals less than 18 inches thick were excluded.

Total coal reserves in the Western Illinois Region, as reported in Bulletin 78, amounted to 8.2 billion tons or about 6 percent of the state's total coal reserves. Strippable reserves in that part of the region for which strippable coal studies have been completed have been estimated at 7.2 billion tons of coal in the ground. This is equivalent to 88 percent of the total minable coal reserves of the region. Figures 3 and 4 show the county-by-county breakdown on strippable and total minable coal reserves.

Locations of coal mines operating in the Western Illinois Region during 1965 are shown in figure 5. Coal has been produced at one time or another in all counties of the region with the sole exception of Henderson County, but only six counties had active mines in 1965. Fulton County is the leading coal producer in the region in cumulative production, having produced more than five times as much as the next largest producer, Knox County. For each county, data on the cumulative production of coal from 1882 to 1965, the total number of active mining years, and the last year of reported production appear in figure 6.

Figures 7 and 8 indicate some general trends in the coal industry from 1948 to 1965. The number of operating mines has declined sharply over the period while the over-all production has shown a modest growth. This growth has been possible because the remaining mines have increased their capacity and improved their productivity through widespread mechanization. As can be seen in figure 7 most of the production in Western Illinois comes from strip mines.

Table 3 gives the average reported value per ton of coal produced by county and year from 1955 to 1965.

CLAY AND CLAY PRODUCTS

Extensive exposures of Pennsylvanian clays and shales occur in the Western Illinois Region, along with lesser exposures of Ordovician and Mississippian shales (fig. 9). These materials form the raw material base for a sizable clay products industry in the area. A number of clay and shale samples from the region have been collected and tested and the results were published by White (1960), Parham (1960), White and Lamar (1960), Parham (1961), Parham and White (1963), White (1963), and White and O'Brien (1964). Figure 10 shows the localities from which the samples were collected.

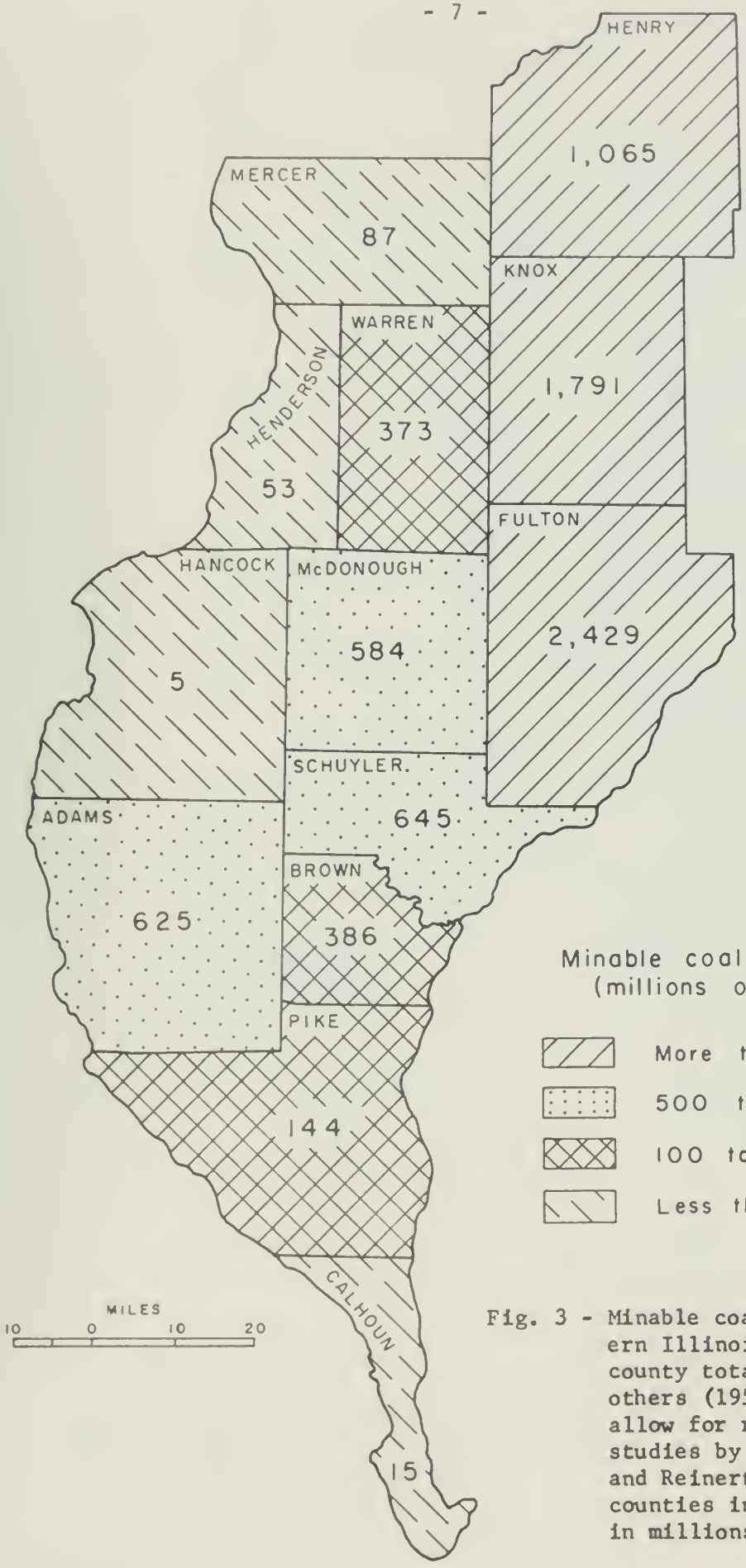

Fig. 3 - Minable coal reserves in the Western Illinois Region. Data for county totals are from Cady and others (1952) with adjustments to allow for recent strippable coal studies by Smith and Berggren (1963) and Reinertsen (1964). Numbers in counties indicate county reserves in millions of tons.

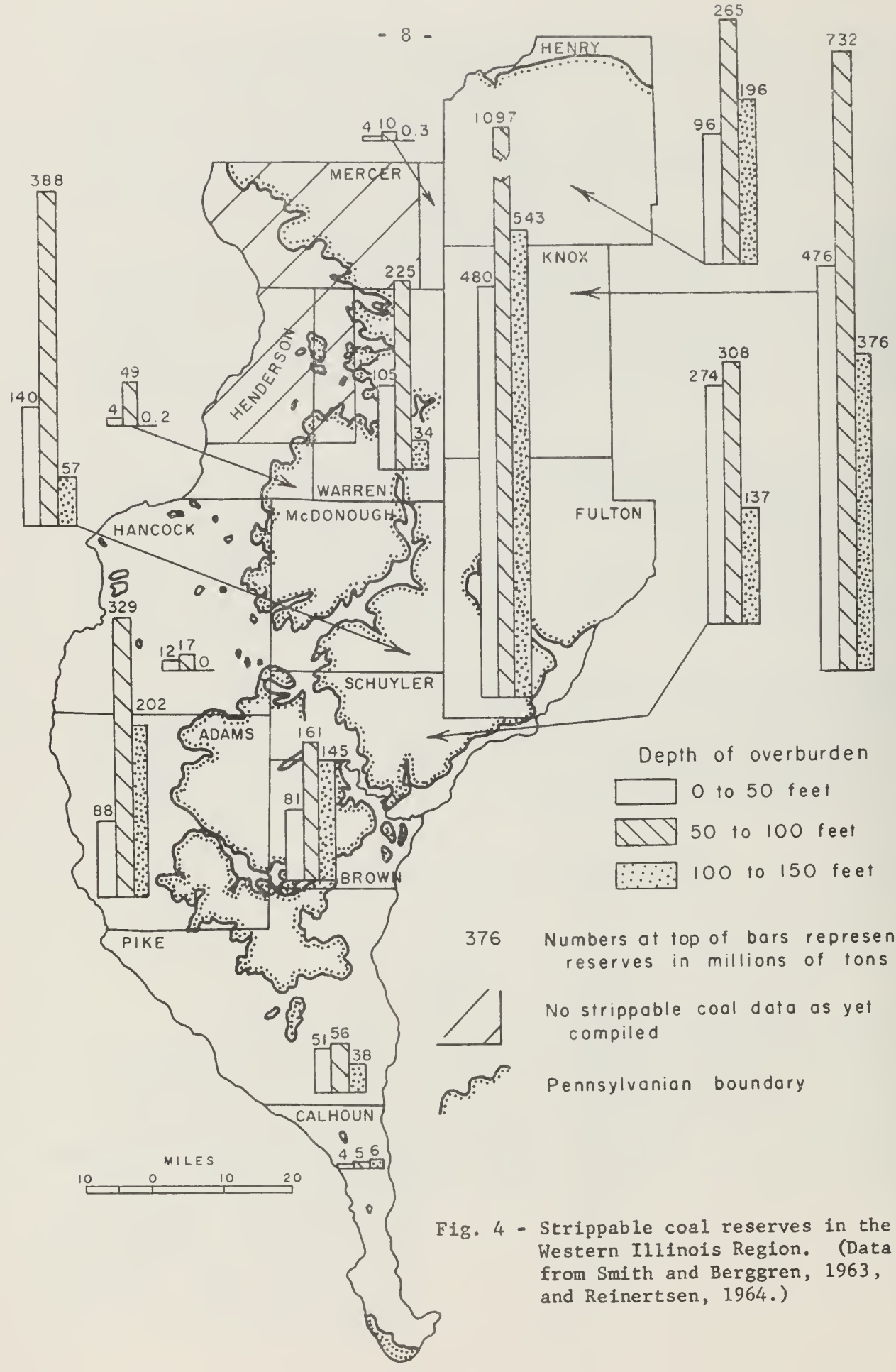

Fig. 4 - Strippable coal reserves in the Western Illinois Region. (Data from Smith and Berggren, 1963, and Reinertsen, 1964.)

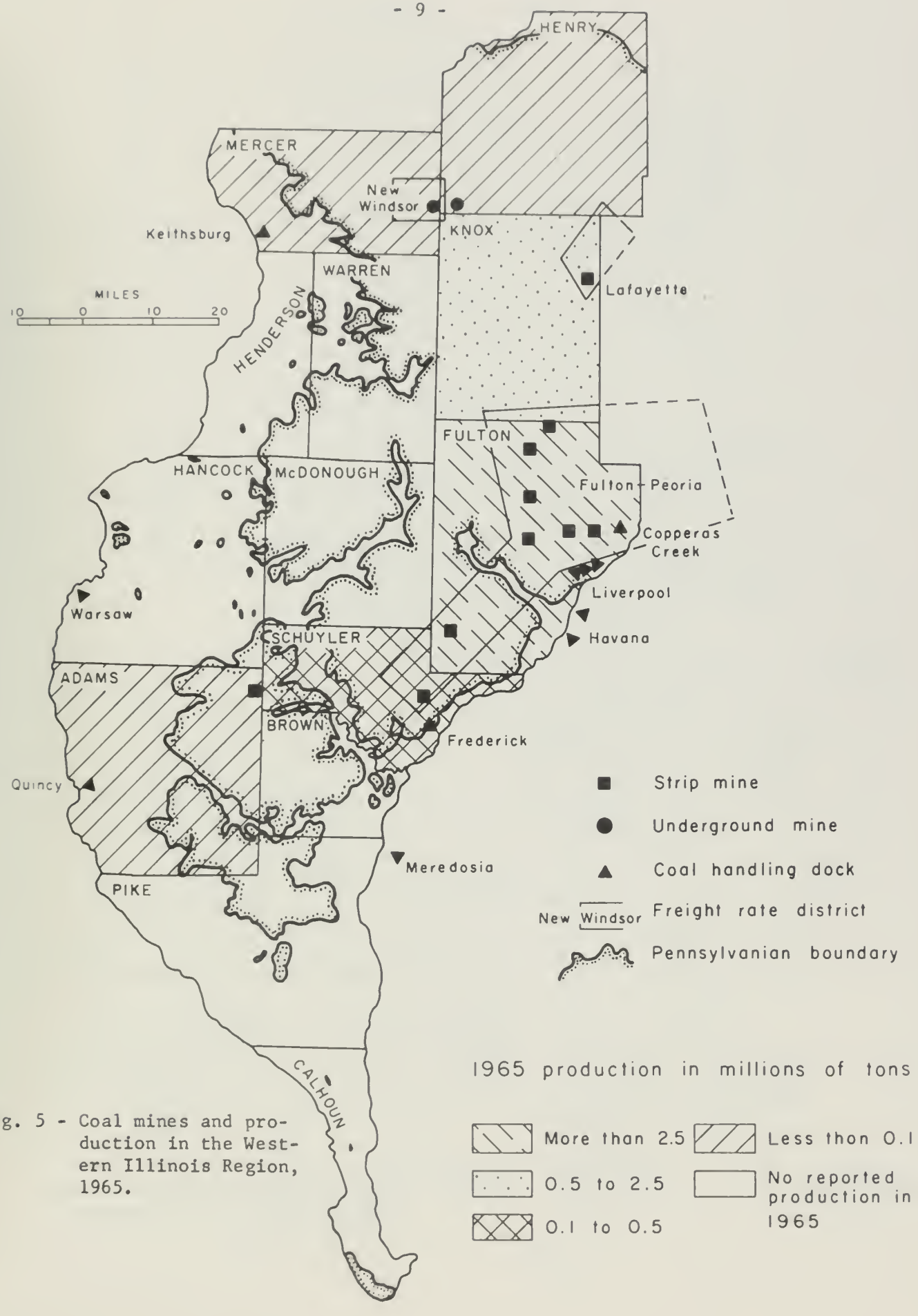

Fig. 5 - Coal mines and production in the Western Illinois Region, 1965.

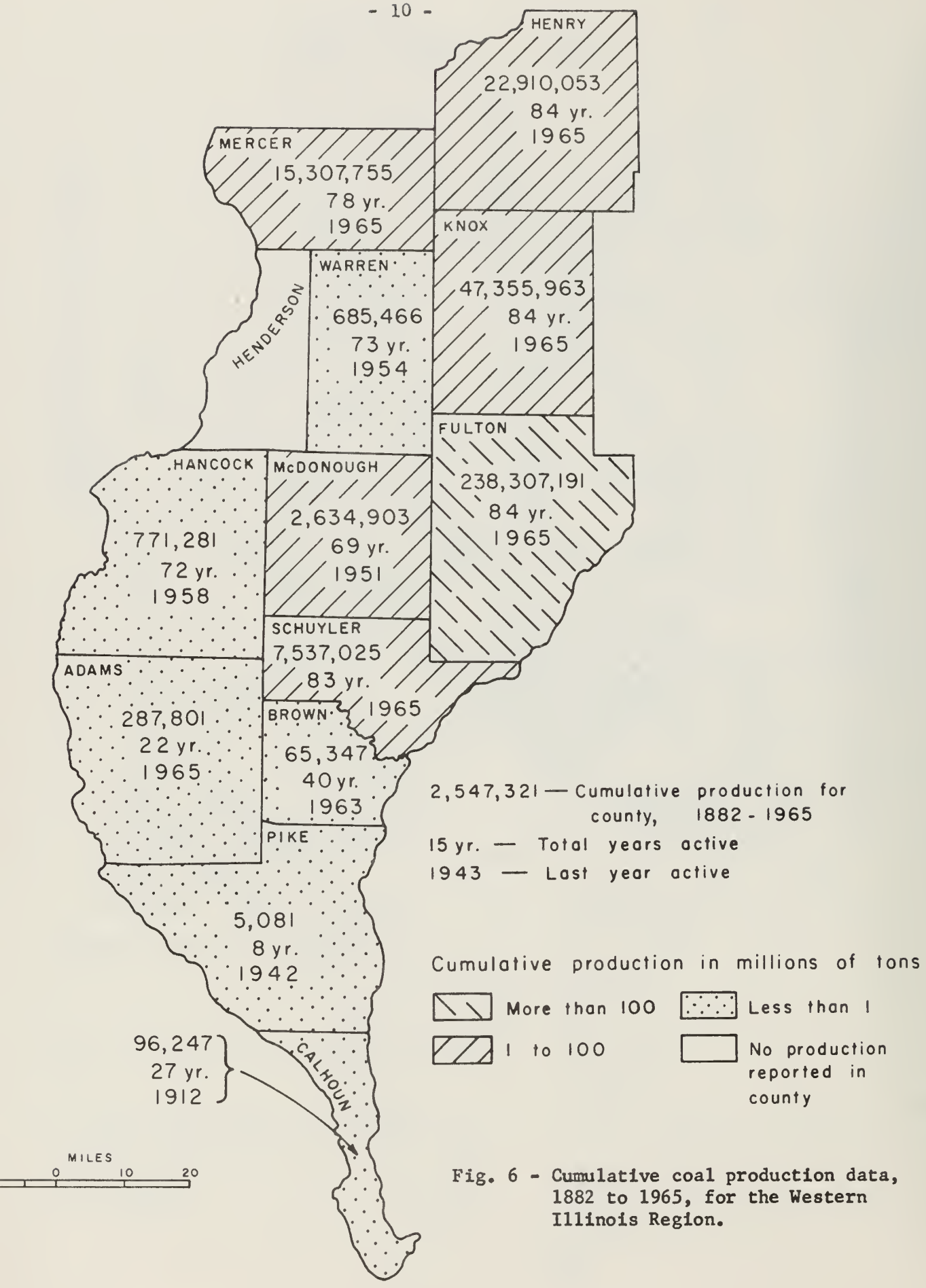

Fig. 6 - Cumulative coal production data, 1882 to 1965, for the Western Illinois Region.

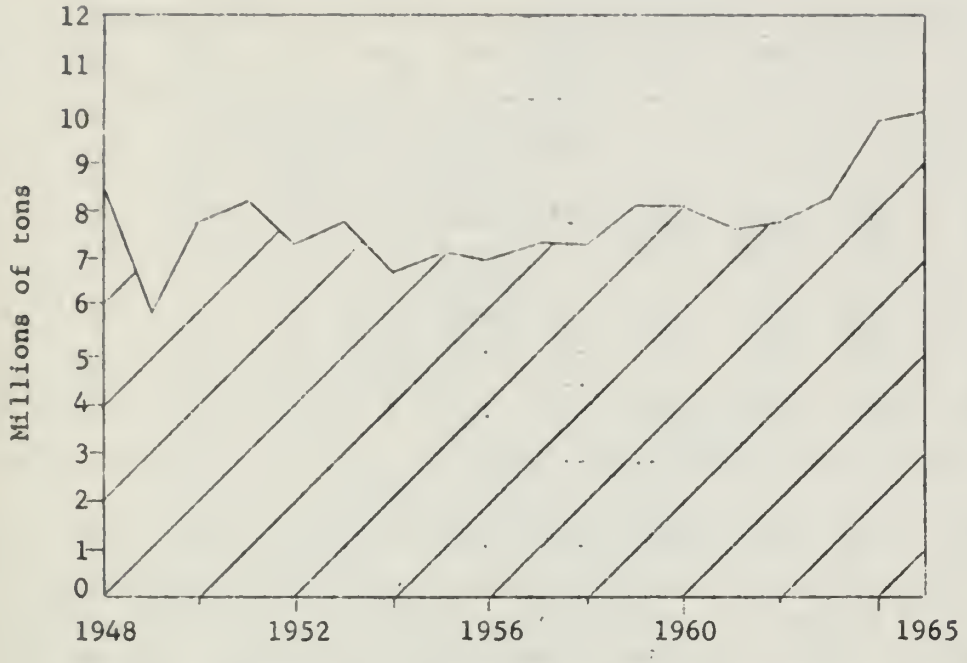

Fig. 7 - Annual coal production in the Western Illinois Region, 1948 to 1965. Practically all of the production came from strip mines; underground mines averaged 3 percent of the annual production.

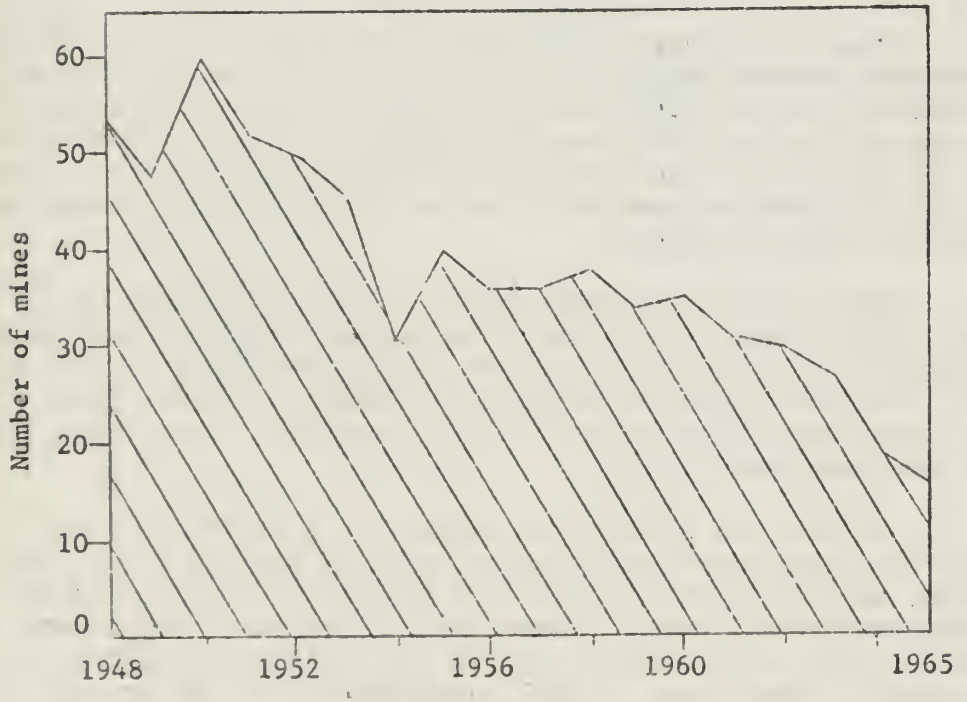

Fig. 8 - Number of operating coal mines in the Western Illinois Region, 1948 to 1965.

TABLE 3 - AVERAGE COAL VALUES*

County	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965
Adams	--	--	--	6.82	4.42	7.13	7.04	6.98	6.99	6.94	6.94
Brown	--	--	--	W	4.42	W	4.33	W	W	--	--
Fulton	3.72	3.86	4.02	4.11	4.18	4.15	4.10	4.06	3.99	3.91	3.94
Hancock	6.15	6.36	6.59	W	--	--	--	--	--	--	--
Henry	5.07	4.50	4.64	4.46	4.49	W	W	W	W	W	W
Knox	3.71	W	W	4.09	4.17	4.09	W	W	W	W	W
Mercer	--	W	W	5.03	W	5.19	5.18	3.00	4.21	W	5.20
Schuyler	5.31	5.49	5.51	W	W	W	W	W	W	W	W
State average	3.66	3.84	4.00	4.02	4.06	4.00	3.91	3.86	3.80	3.79	3.74

*Source: U. S. Bureau of Mines. Average value per ton = value received or charged for coal f.o.b. mines as reported to the U. S. Bureau of Mines. Includes a value for coal not sold but used by producers, such as mines fuel and coal coked, as estimated at average prices that might have been received if such coal had been sold commercially.

W = Withheld to avoid revealing confidential data.

Figure 11 indicates the approximate limits of the various grades of strippable refractory clay deposits. The term "strippable" is used rather loosely to indicate those areas where the ratio of overburden to clay thickness falls within the generally accepted limits of present mining practices and economics. More detailed information on locations, tonnages, and types of clay resources available can be obtained from Illinois State Geological Survey personnel.

White and Lamar (1960) compiled results of tests on 125 samples of clay that had been run by Survey personnel over a period of years. Of these samples, 33 were collected from localities in the Western Illinois Region. The most frequently suggested products for which these clays could be used were drain tile, structural clay products, flower pots, common brick, and face brick.

In order to evaluate the nature and possible uses for light-burning clay deposits of Knox County, about 40 samples of the underclay below the Colchester (No. 2) Coal were collected, tested, and the results were published by Parham (1960). Almost all of the clays tested were found suitable for use in the manufacture of lightweight aggregate, structural clay products, sewer pipe, flower pots, drain tile, and pottery. The southern part of Knox County was reported to be the best area for clay prospecting.

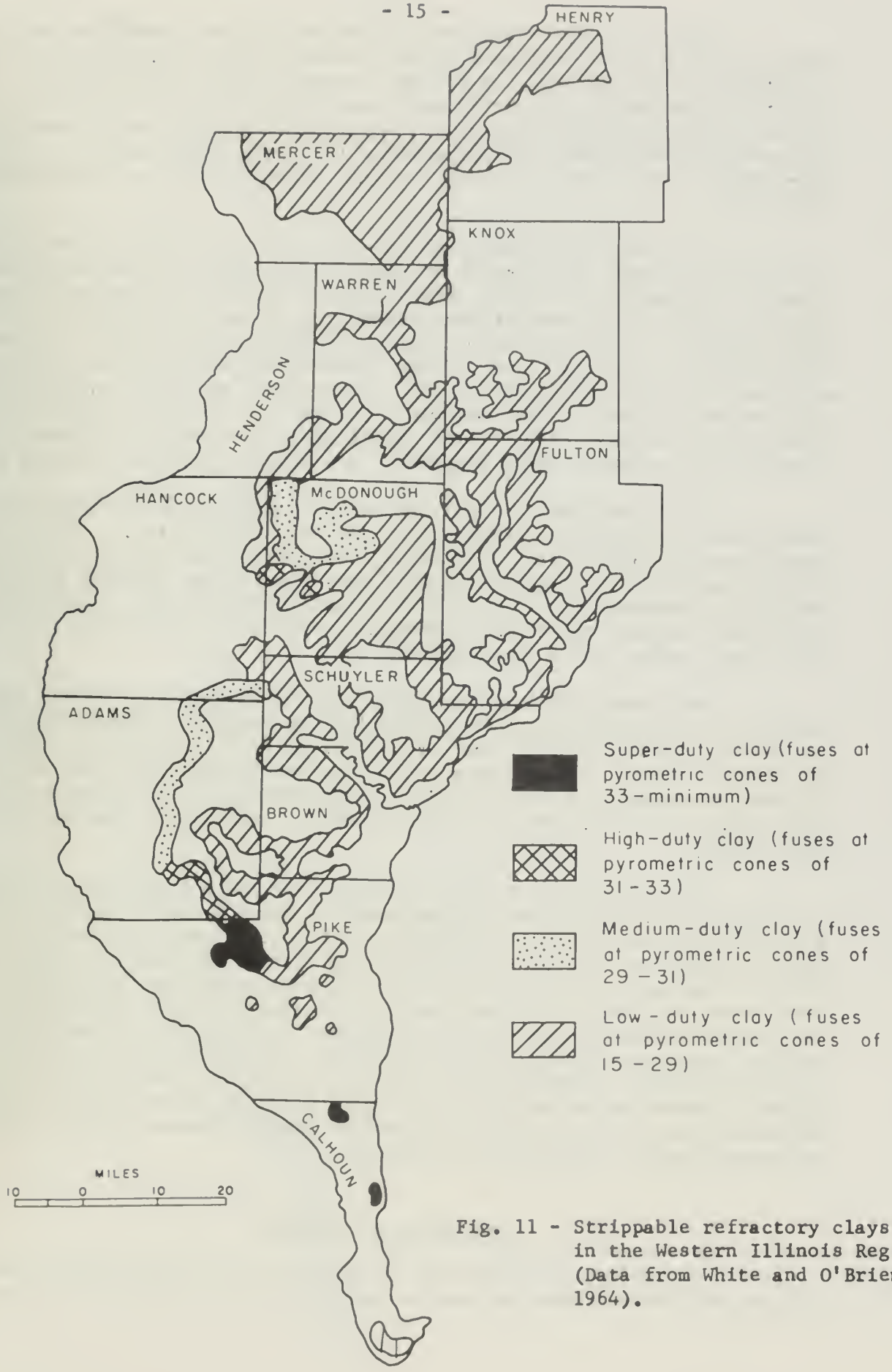

Fig. 11 - Strippable refractory clays in the Western Illinois Region. (Data from White and O'Brien, 1964).

Parham (1961) tested some 95 samples of lower Pennsylvanian underclays collected from localities in Rock Island, Henry, and Mercer Counties to determine their suitability for use in making fired clay products. About a third of the samples collected were from Henry and Mercer Counties, which lie in the Western Illinois Region. Tests indicated that one or more of the samples were suitable for stoneware, structural clay products, sewer pipe, drain tile, flower pots, art pottery, bonding clay, and lightweight aggregate.

In order to determine the potential uses for buff-burning clays of Western Illinois, 110 samples of clays in the Spoon and Abbott Formations (lower Pennsylvanian) in Adams, Brown, Fulton, Hancock, Henderson, McDonough, Schuyler, and Warren Counties were collected, tested, and reported on by White (1963). A large number of additional samples were tested, but were not included in White's report. These results are available for public inspection in the Survey's open files. It was found that the clays might be used for one or more of the following: drain tile, fillers, flower pots, flue liners, pottery, refractories, sewer pipe, stoneware, structural clay products, terra cotta, terra sigillata, and bonding clays for molding sands.

Parham and White (1963) collected 66 samples of Pennsylvanian clays from 14 counties in southwestern and southern Illinois. Six of these samples were collected from localities lying within the Western Illinois Region. Samples from Pike and Calhoun Counties were found to be suitable for possible use in the manufacture of flower pots, flue liners, pottery, refractories and refractory cements, sewer pipe, stoneware, structural clay products, drain tile, terra cotta, and terra sigillata.

New construction methods using lighter building materials have increased the market demand for lightweight aggregates. Illinois shales and clays suitable for such use were discussed by White (1960) and White and O'Brien (1964). These reports give the results obtained from testing 12 samples collected from localities in the Western Illinois Region. At the present time there are no plants producing lightweight aggregate in this region.

The production of clay products by Illinois manufacturers has had a value of 50 to 60 million dollars annually for the past decade. In recent years, the manufacturers in the Western Illinois Region have produced at a fairly consistent rate of 11 to 12 million dollars per year, or about one-fifth of the state's total production. In 1965 production was reported from seven clay products plants and two raw clay producers operating in the region. These plants are manufacturing a variety of clay products: pottery, stoneware, earthenware, drain tile, face brick, vitreous china plumbing fixtures, common brick, fire-clay brick, and electrical porcelain. Figure 12 shows the value of clay products produced in the Western Illinois Region between 1955 and 1965. The leading producer since 1960 has been McDonough County, followed by Knox County.

LIMESTONE AND DOLOMITE

In Illinois the principal products of the stone industry are crushed and broken stone for road surfacing, for agricultural limestone,

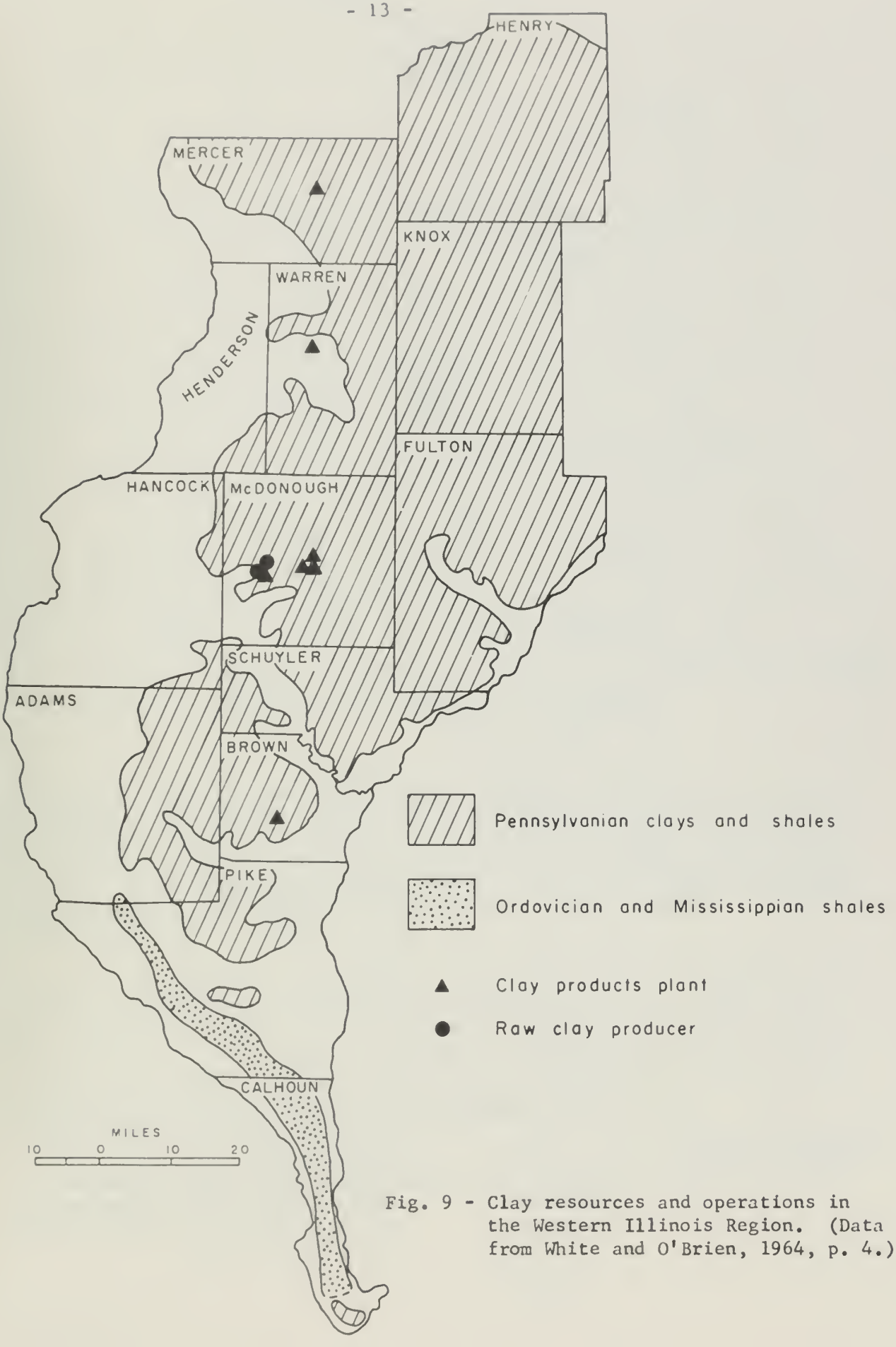

Fig. 9 - Clay resources and operations in the Western Illinois Region. (Data from White and O'Brien, 1964, p. 4.)

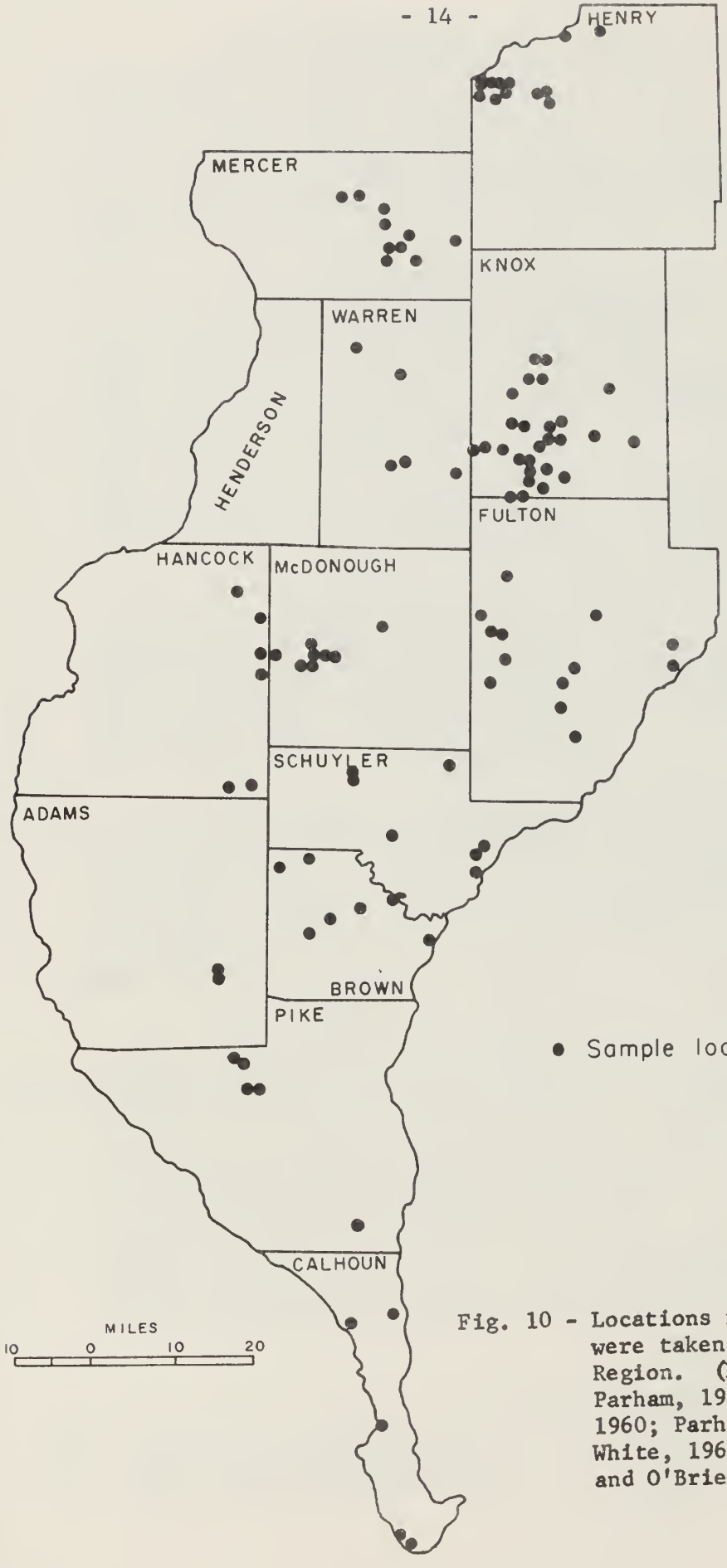

Fig. 10 - Locations from which clay samples were taken in the Western Illinois Region. (Data from White, 1960; Parham, 1960; White and Lamar, 1960; Parham, 1961; Parham and White, 1963; White, 1963; and White and O'Brien, 1964.)

Fig. 12 - Reported value of clay products production in the Western Illinois Region, 1955 to 1965.

and for aggregate used in concrete and bituminous roads and in concrete structures. The Western Illinois Region possesses extensive surface and near-surface deposits of carbonate rocks (fig. 13). In the eastern half of the region, there are widespread exposures of thin Pennsylvanian limestones. In the western half of the region, the limestones of Mississippian age predominate, with lesser exposures of older rocks outcropping in the southern part of the region.

In addition to the sizable tonnages of crushed and broken stone produced for aggregates, high-purity limestone from the Burlington Limestone Formation is quarried in the Quincy-Marblehead area of Adams County. This limestone is used as the raw material feed for two lime plants operating in the region. However, production data for lime kiln feed are not included in the totals reported for crushed and broken stone. The lime industry will be discussed in a later section of this report.

The Calcium Carbonate Company of Quincy produces ground limestone for whiting and other specialty products which require light color and/or high purity.

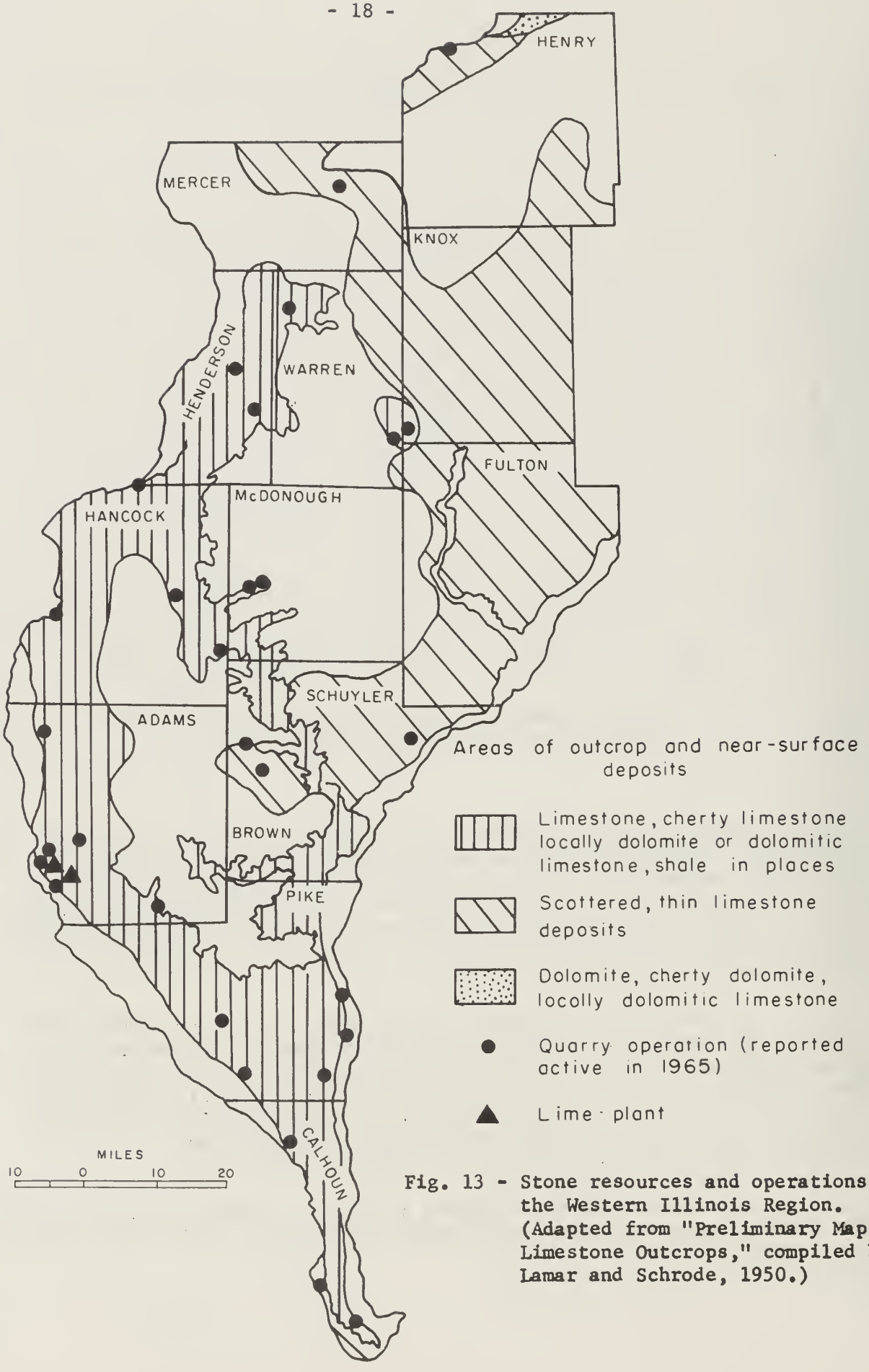

Fig. 13 - Stone resources and operations in the Western Illinois Region. (Adapted from "Preliminary Map of Limestone Outcrops," compiled by Lamar and Schrode, 1950.)

Detailed information concerning the limestone and dolomite resources of the Western Illinois Region can be found in the following Illinois Geological Survey reports: Krey and Lamar (1925, p. 205-212, 216-219, 227, 236-239, 283, 298-299, 301, 304, 309)—a county-by-county survey of the region's limestone resources; Lamar (1926, p. 6-15)—Calhoun County; Willman (1943, p. 85-87)—high-purity dolomite resources of the Grafton-Hardin region—Calhoun and Jersey Counties; Lamar (1957)—compilation of chemical analyses of Illinois limestones and dolomites; Harvey (1964)—Mississippian limestone resources in Fulton, McDonough, and Schuyler Counties; and Lamar (1966)—high-purity limestone resources in Illinois.

Regional production and value of crushed and broken stone for the years 1955 to 1965 are shown in figure 14. In 1965, 30 quarries, located in 12 of the 13 counties of the Western Illinois Region, reported a combined production of 3.2 million tons or 7.5 percent of the state's total stone production. The three leading counties in crushed stone production, in order of their 1965 tonnages, were Pike, Henderson, and Hancock.

SAND AND GRAVEL

Sand and gravel deposits are important natural resources that occur in many places in Illinois. These deposits are, with the exception of a few deposits in extreme southern and western Illinois, related directly or indirectly to past glacial activity. The Illinoian and Wisconsinan glaciations produced the most important economic sand and gravel deposits in the state. An explanation of the origin of these deposits was prepared by Lamar and Willman (1958). Figure 15 shows the location of the major known sand and gravel resources in the Western Illinois Region.

It is not possible to give any meaningful data on reserves. As sand and gravel are low-value commodities, the market area in which they can compete is usually quite sharply restricted. Transportation costs often represent a greater portion of the delivered price than the initial value of the raw material at the pit site. Because of this, a deposit usually must be quite close to the market area to be economic. To be more specific, a nationwide study of transportation patterns has shown that rail hauls for aggregates average 80 to 90 miles; water hauls average 30 to 35 miles; and truck hauls, accounting for about 80 percent of sand and gravel transportation, probably average well under 30 miles (Davidson, 1965, p. 1). It should be noted that in certain localities, economic conditions permit hauling distances that vary considerably from these national averages. Detailed sand and gravel resource maps have been prepared for Henry, Mercer, Henderson, Warren, Hancock, McDonough, Adams, Schuyler, Brown, and Pike Counties. These maps are available for inspection in the open files of the Geological Survey, and copies of them are also available for purchase.

Quantities and value of sand produced in the Western Illinois Region between 1955 and 1965 are shown in figure 16. In 1965, 10 pits in 6 counties reported production totaling 323,000 tons, or 2.4 percent of the state total for the same year. The leading county in terms of tonnage produced in 1965 was Fulton.

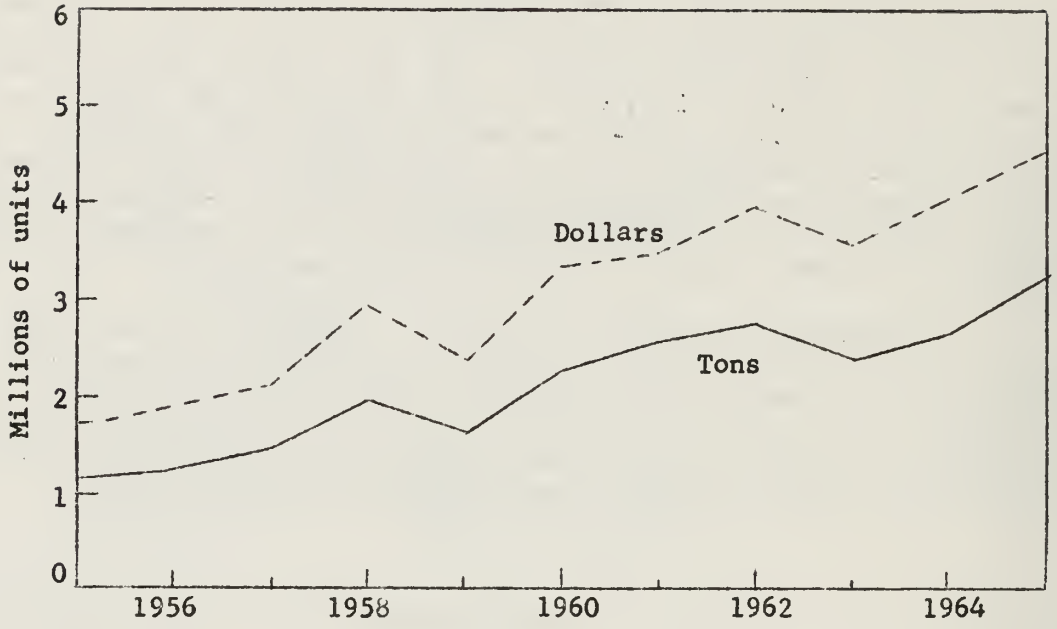

Fig. 14 - Reported production and value of crushed and broken stone in the Western Illinois Region, 1955 to 1965.

Production and value of gravel produced in the Western Illinois Region during the years from 1955 to 1965 are shown in figure 17. Seven gravel pits located in 6 counties reported a combined production of 462,000 tons or 2.5 percent of the Illinois gravel production for the year. The leading gravel producing county was Fulton. Small tonnages of natural bonded molding sand are produced by one company operating a pit in Henry County near the town of Colona (fig. 15).

OIL AND GAS

The Western Illinois Region includes the western edge of the Illinois Basin petroleum-producing area. Crude oil has been produced in only five of the region's 13 counties—Adams, Brown, Hancock, McDonough, and Schuyler. In addition, natural gas production has been achieved in Pike and Adams Counties. The locations of the various known oil and gas fields in the region are shown in figure 18. All of the production has come from Silurian rocks with the exception of the two northernmost fields, which produced from the Devonian.

Figure 19 shows the region's crude oil production during the last decade. After reaching a peak of 179,000 barrels in 1960, the production rate has declined sharply to about one-third of its peak level. In 1965 the region produced 54,000 barrels, or less than a tenth of one percent of the state total for that year. Table 4 shows the 1965 production and cumulative production (1888-1965) for each of the five oil-producing counties.

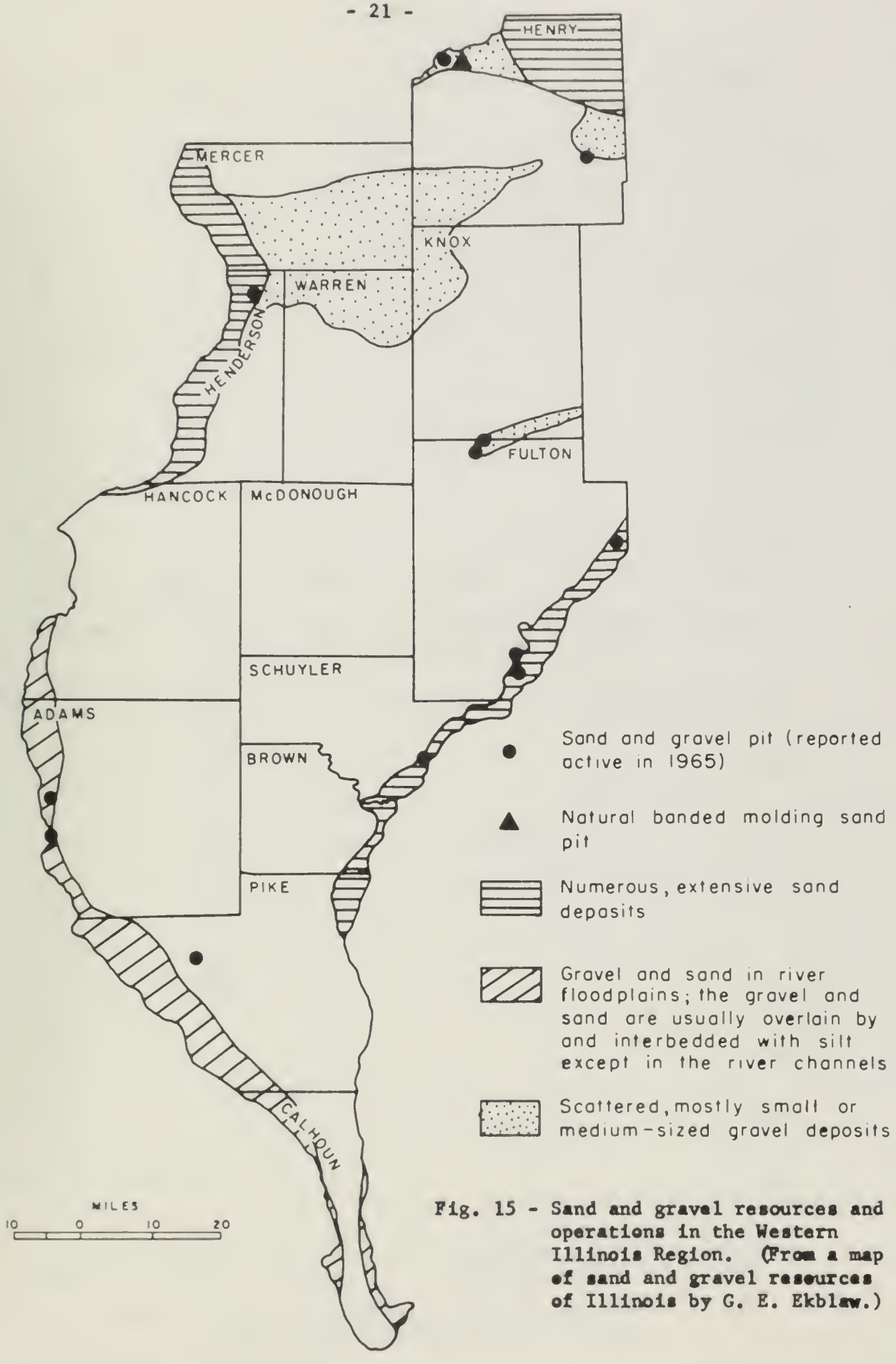

Fig. 15 - Sand and gravel resources and operations in the Western Illinois Region. (From a map of sand and gravel resources of Illinois by G. E. Ekblaw.)

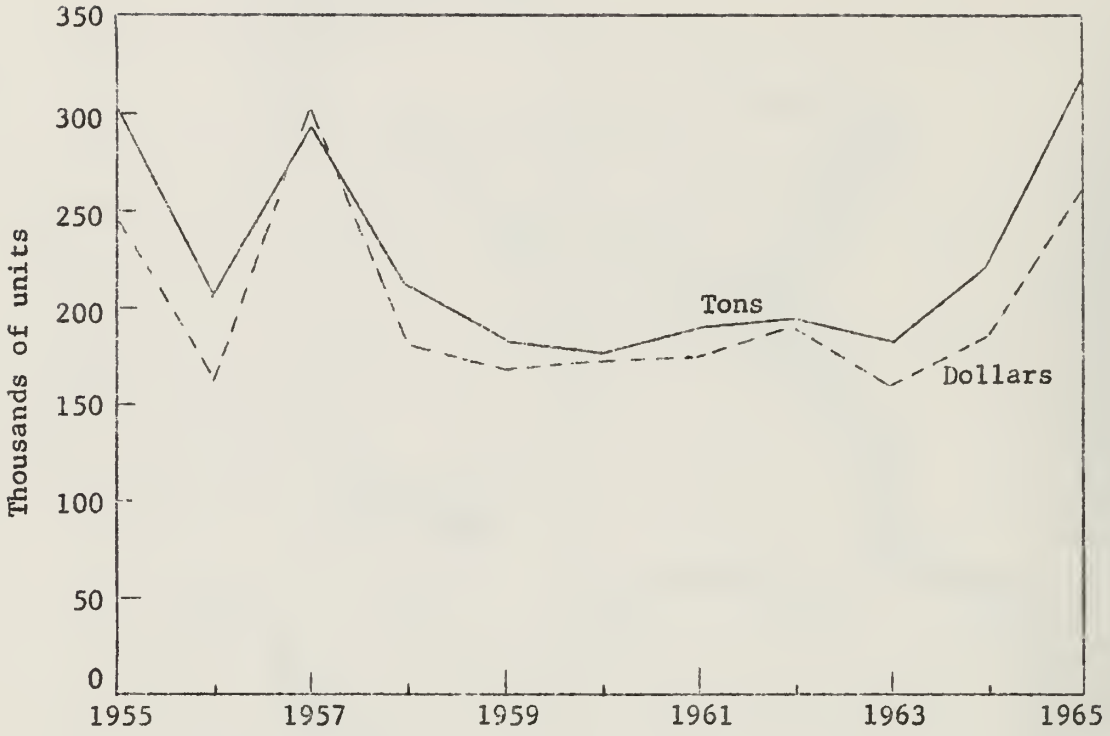

Fig. 16 - Reported production and value of sand in the Western Illinois Region, 1955 to 1965.

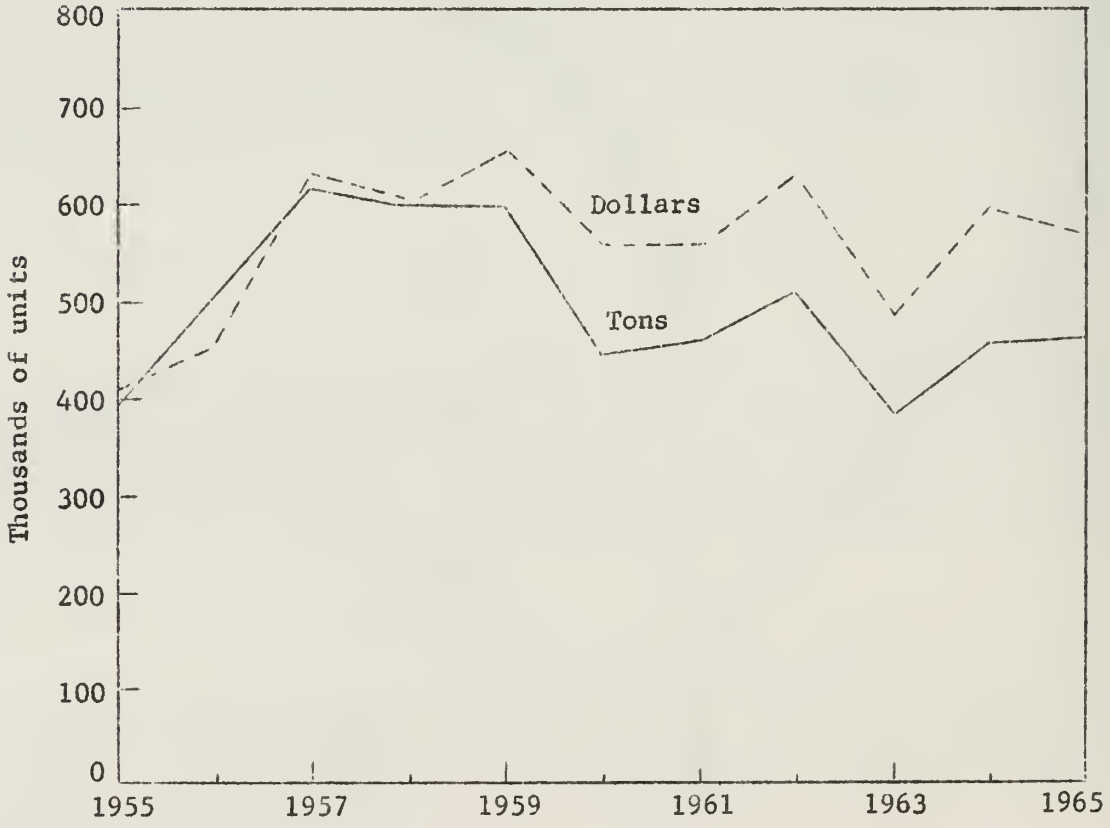

Fig. 17 - Reported production and value of gravel in the Western Illinois Region, 1955 to 1965.

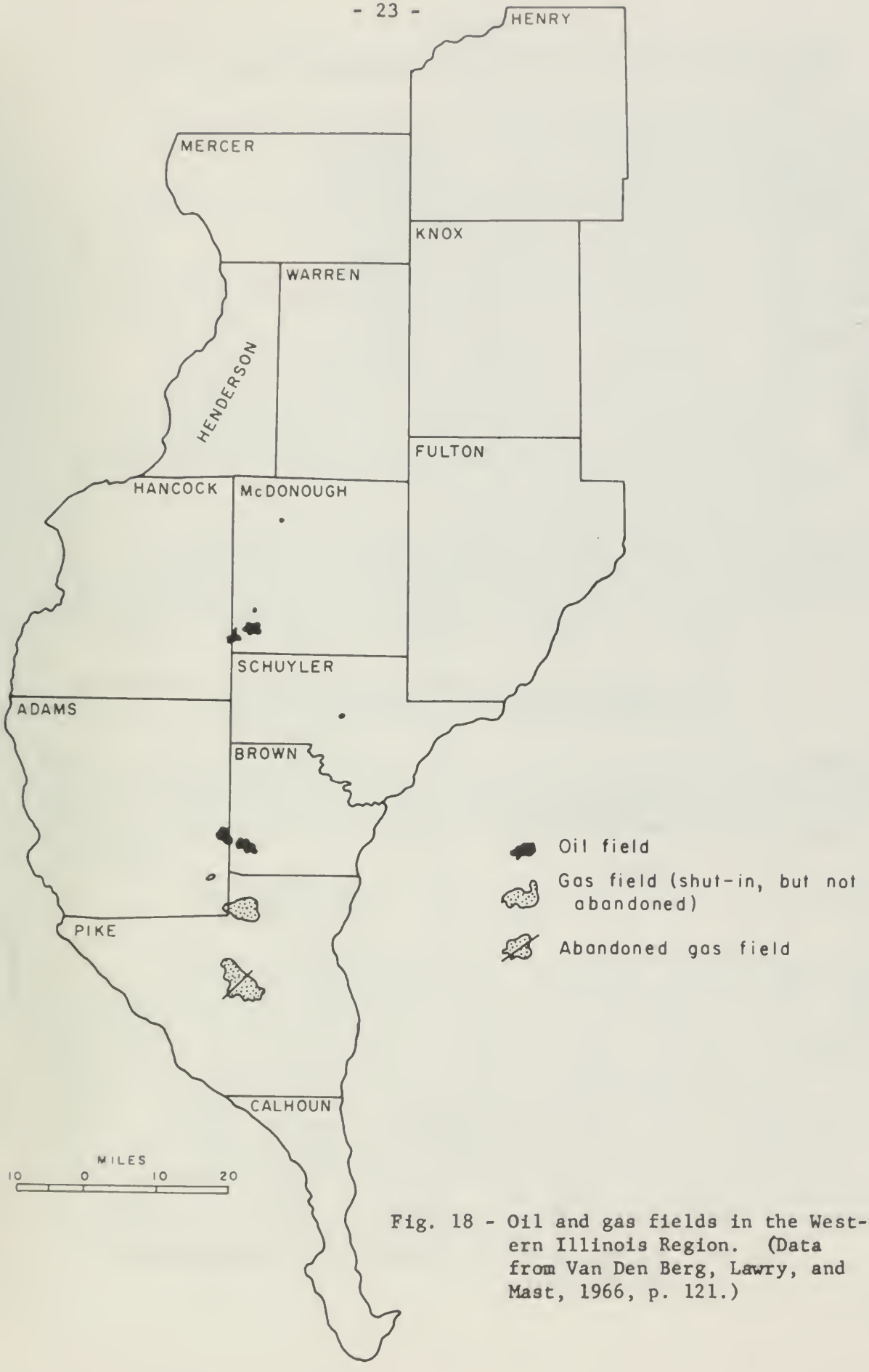

Fig. 18 - Oil and gas fields in the Western Illinois Region. (Data from Van Den Berg, Lawry, and Mast, 1966, p. 121.)

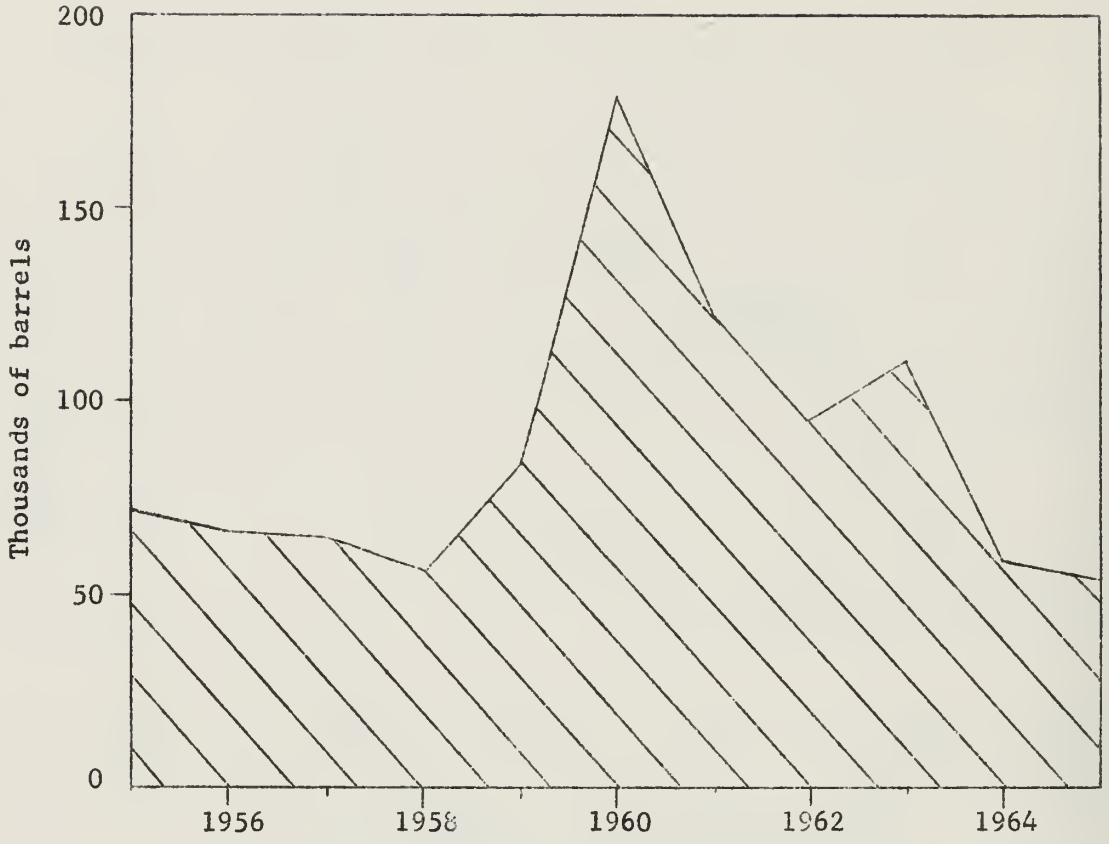

Fig. 19 - Crude oil production in the Western Illinois Region, 1955 to 1965.

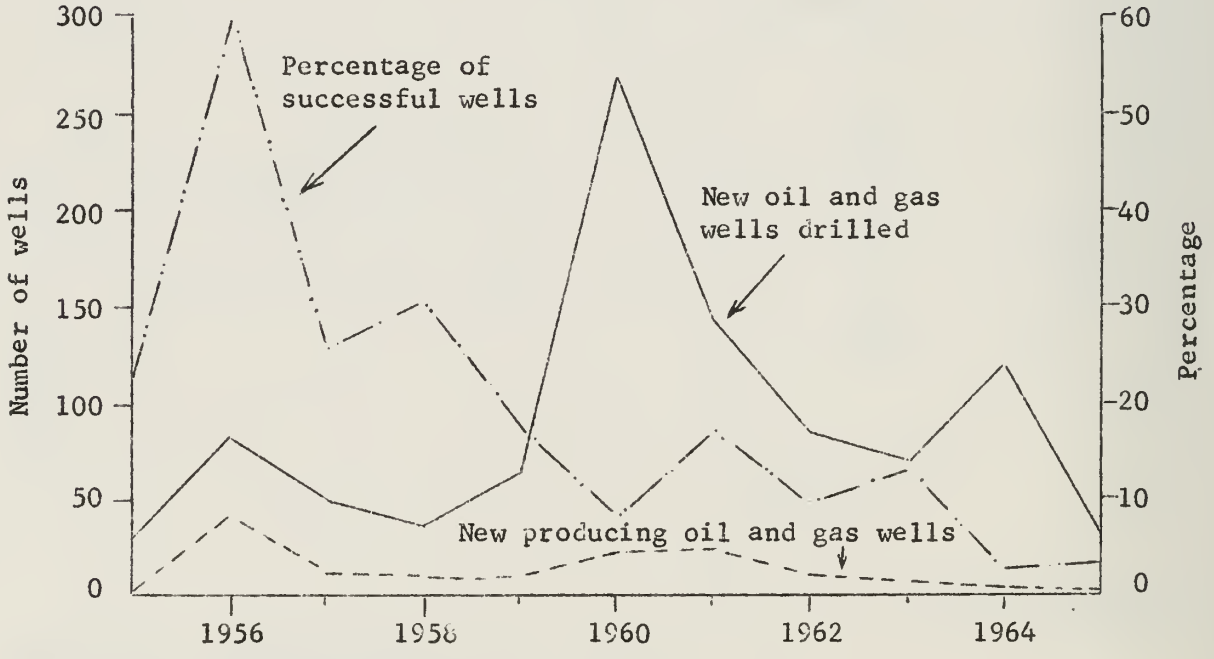

Fig. 20 - Drilling activity in the Western Illinois Region, 1955 to 1965.

TABLE 4 - CRUDE OIL PRODUCTION STATISTICS FOR THE WESTERN ILLINOIS REGION

County	Cumulative production* (1888-1965)	1965 Production		
		Barrels	Value†	Percent of state total
Adams	155,000	8,000	$ 23,440	0.01
Brown	205,000	2,000	5,860	----
Hancock-McDonough	5,076,000	44,000	128,920	0.07
Schuyler	1,000	----	----	----
Total	5,437,000	54,000	$158,220	0.08

*Measured in barrels.

†Average price estimated at $2.93 per barrel.

The amount of drilling activity in the Western Illinois Region has varied quite a bit during the past decade (fig. 20). Although the largest number of wells was drilled in 1960, the best year for discoveries was in 1956 when the success ratio was 59 percent.

UNDEVELOPED MINERALS OF POTENTIAL IMPORTANCE

Illinois possesses a number of mineral deposits that, at present, are not being exploited. The low grade of the materials and/or the high cost of processing them have made their exploitation uneconomic in the past. A brief discussion of these resources and the problems associated with their use follows.

Oil Shale

As early as 1870 (Worthen, 1870, p. 105) the presence of oil was reported in certain shales in Illinois. However, no comprehensive testing or evaluation of these shales was carried out until 1956 when members of the staff of the Illinois State Geological Survey collected and tested 114 samples taken from 41 counties in the state (Lamar, Armon, and Simon, 1956). Eleven of the samples were collected from locations in the Western Illinois Region. Only one of the eleven samples yielded more than 20 gallons of oil per ton of shale. There are vast reserves of thick oil shale in Colorado, Utah, and Wyoming that average more than 30 gallons per ton of shale. In contrast, the lower yielding shales of Illinois are, for the most part, only 2 to 5 feet thick. Therefore, in the light of present technology, economic use of Illinois oil shales is unlikely. Figure 21 indicates the locations and yields of tested samples.

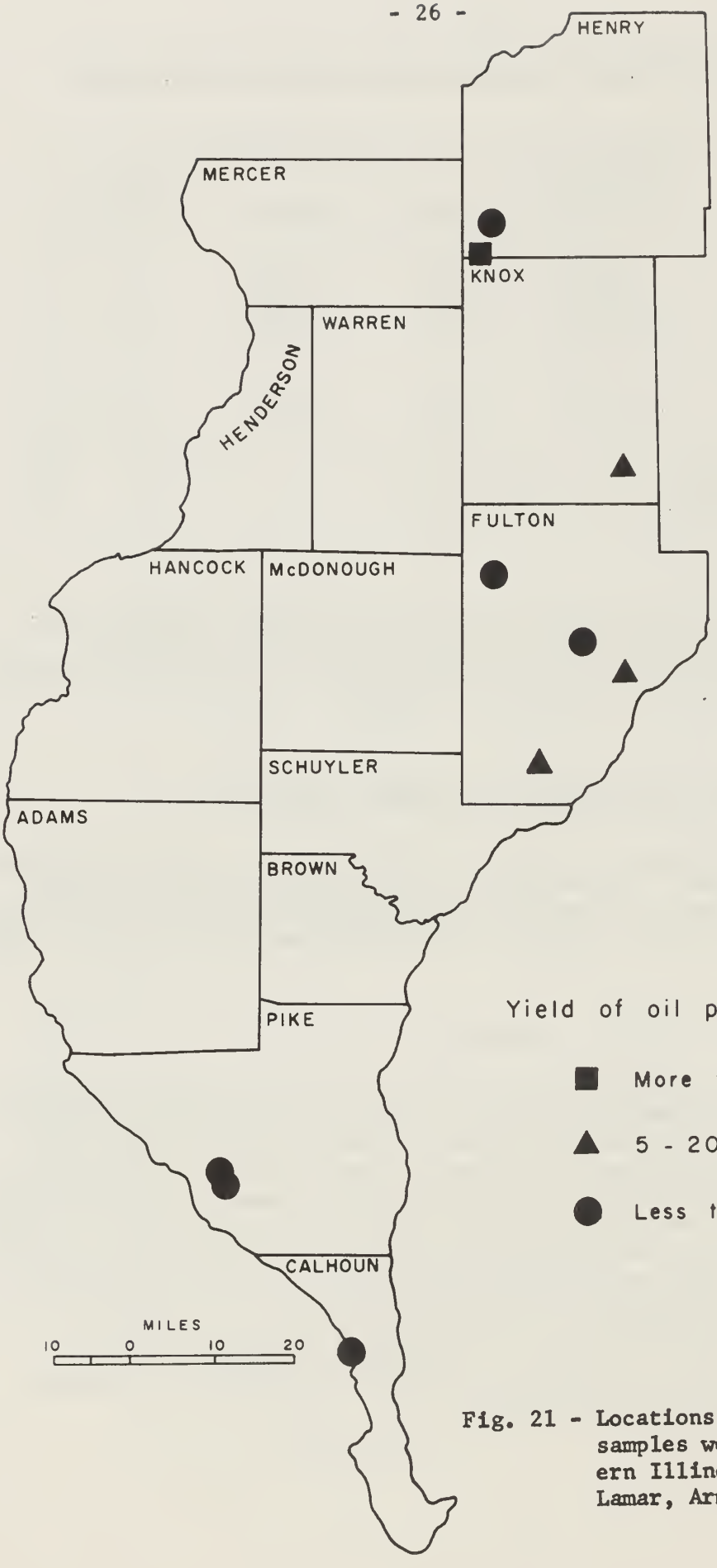

Fig. 21 - Locations from which oil shale samples were taken in the Western Illinois Region. (Data from Lamar, Armon, and Simon, 1956.)

Feldspar-Bearing Sands

Feldspar, an essential constituent in the manufacture of glass, pottery, and ceramics, is a mineral occurring in many Illinois sand deposits. In 1965 Illinois was the third largest consumer of ground feldspar in the United States, using 66,160 tons, all of which came from out-of-state because no feldspar was produced in Illinois (U. S. Bur. Mines, 1967, p. 4). At present, feldspar is imported from such distant sources as North Carolina and South Dakota and, therefore, substantial freight charges are involved. For this reason, it has been suggested that certain of the glacial and Recent sands in Illinois might be beneficiated to produce a feldspar concentrate of acceptable grade that could supply all or part of the state's needs.

The locations of sand samples tested by Willman (1942) and Hunter (1965) for feldspar content are shown in figure 22. Twelve samples of feldspar-bearing sands—three from the Prophetstown area, five from the Oquawka area, two from along the Illinois River, and two from along the Mississippi River above the mouth of the Missouri River—were collected and studied by Willman. Hunter restudied one of Willman's samples and also collected one sample from a new locality in Henderson County. When tested, the samples from the Western Illinois Region yielded highly variable results. The tests consistently showed more soda-lime feldspar than potash feldspar in the samples. Samples from the Prophetstown and Oquawka areas yielded the highest feldspar content in the region.

A key factor in the utilization of feldspar for ceramics and glass-making purposes is its iron oxide content. The maximum allowable for flint (clear) glass is 0.05 percent iron oxide (Fe_2O_3); for amber glass it is 0.50 percent (U. S. Bur. of Mines, 1965, p. 322). Hunter (1965) studied the mode of occurrence and amount of iron oxide in the feldspars of his sand samples. He found that the sands contained potash feldspar soda-lime feldspar, and feldspathic rock fragments, and that the potash feldspar contained less iron oxide than either of the other forms. When the feldspars were treated with acid in the laboratory, their iron oxide content was reduced to near commercial grade. Treated samples of potash feldspar contained from 0.10 to 0.31 percent iron oxide, whereas treated soda-lime feldspar had from 0.16 to 0.56 percent.

Pyrite (Coal Brasses)

All coals contain sulfur in varying amounts; the sulfur occurs in three forms—as pyrite, as organic compounds, and as sulfates. Much of the pyrite, known as "coal brasses" is removed during the coal cleaning processes. However, because of the lack of a market for them, they are usually discarded.

During World War I when sulfur was in short supply, plants at Danville and Gillespie, Illinois, recovered pyrite from coal. This pyrite was later shipped to Fairmont, West Virginia, for processing into sulfuric acid. However, when the war ended and normal economic conditions resumed, these plants were closed down because they were no longer economically competitive (Zimmerman and Roman, 1967, p. 62). Again during World War II several plants operated for a period of time recovering pyrite from coal for its sulfur content.

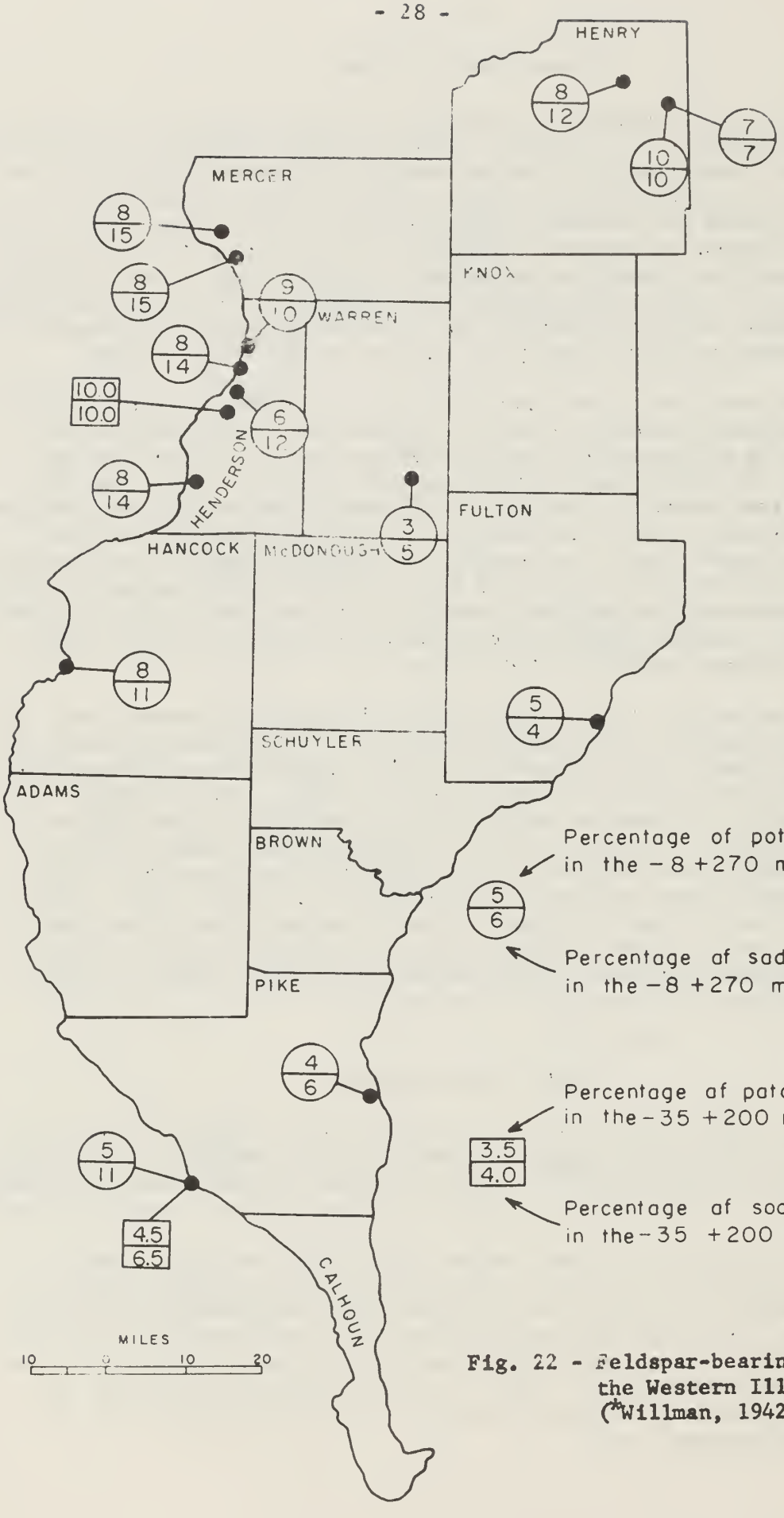

Fig. 22 - Feldspar-bearing sands in the Western Illinois Region. (*Willman, 1942; +Hunter, 1965.)

In 1952 when sulfur was again scarce on the world market, Voskuil (1952) prepared a study on the market outlook for sulfur recoverable from coal with particular emphasis on Illinois and the Midwest regional market. This study indicated that if the price for sulfur were sufficiently high, it might be feasible to produce by-product sulfuric acid from coal brasses. However, during the 1950's and early 1960's, sulfur production tended to exceed consumption, mainly because of the rapid growth in sulfur recovery from sour natural gas. As a result, prices were at one time depressed to as low as $20 per ton. Since then the situation has reversed itself again, and consumption has exceeded production for the past several years with stockpile withdrawal making up the difference. As a result, the price of domestic sulfur has steadily increased and is now over $32 per ton, f.o.b. mines.

In addition to the rising demand for sulfur, the coal industry is being faced with more stringent air pollution controls which will require that the sulfur levels in many coals be reduced below their present level. Therefore, if the pyrite must be removed in order to comply with these regulations, an attempt to recover costs by selling the pyrite has considerable merit. These two developments have put new light on the feasibility of economically recovering coal brasses to produce sulfuric acid and iron concentrates. Recently, Zimmerman and Roman (1967) discussed at some length the technical and economic aspects of such recovery schemes. Given a coal washing plant which is capable of producing 10,000 tons of clean coal per day and an acid plant with a capacity of 700 short tons per day, then the before-taxes profit on the sulfuric acid produced by treating the recovered pyrites would be $11.72 per ton of acid. In addition, the plant would be capable of producing iron calcine or sinter, which should yield a profit of $5.75 per ton. The combined credits from the sale of these products would reduce the cost of coal by $.98 per ton. In addition, there are possibilities of obtaining supplemental credits from high-pressure steam if such waste heat can be utilized. Therefore, the prospects for commercial recovery of pyrites from coal for subsequent processing into sulfuric acid and iron concentrates appear to be quite promising.

PROCESSING, TRANSPORTATION, AND DISTRIBUTION FACILITIES

The Western Illinois Region possesses, in addition to primary mineral production facilities, various processing, transportation, and distribution facilities related to the mineral industries of the region. The locations of these facilities are shown in figures 23 and 24.

Nonmetallic

Two of the state's five lime plants are located in the Western Illinois Region. Both of the plants are located in Adams County where their kiln feed is produced from adjacent underground mines. The Burlington Limestone of Valmeyeran (lower Mississippian) age is the source of raw material. Marblehead Lime Company, a division of General Dynamics Corporation, operates a mine and lime plant at Marblehead which produces high-calcium lime.

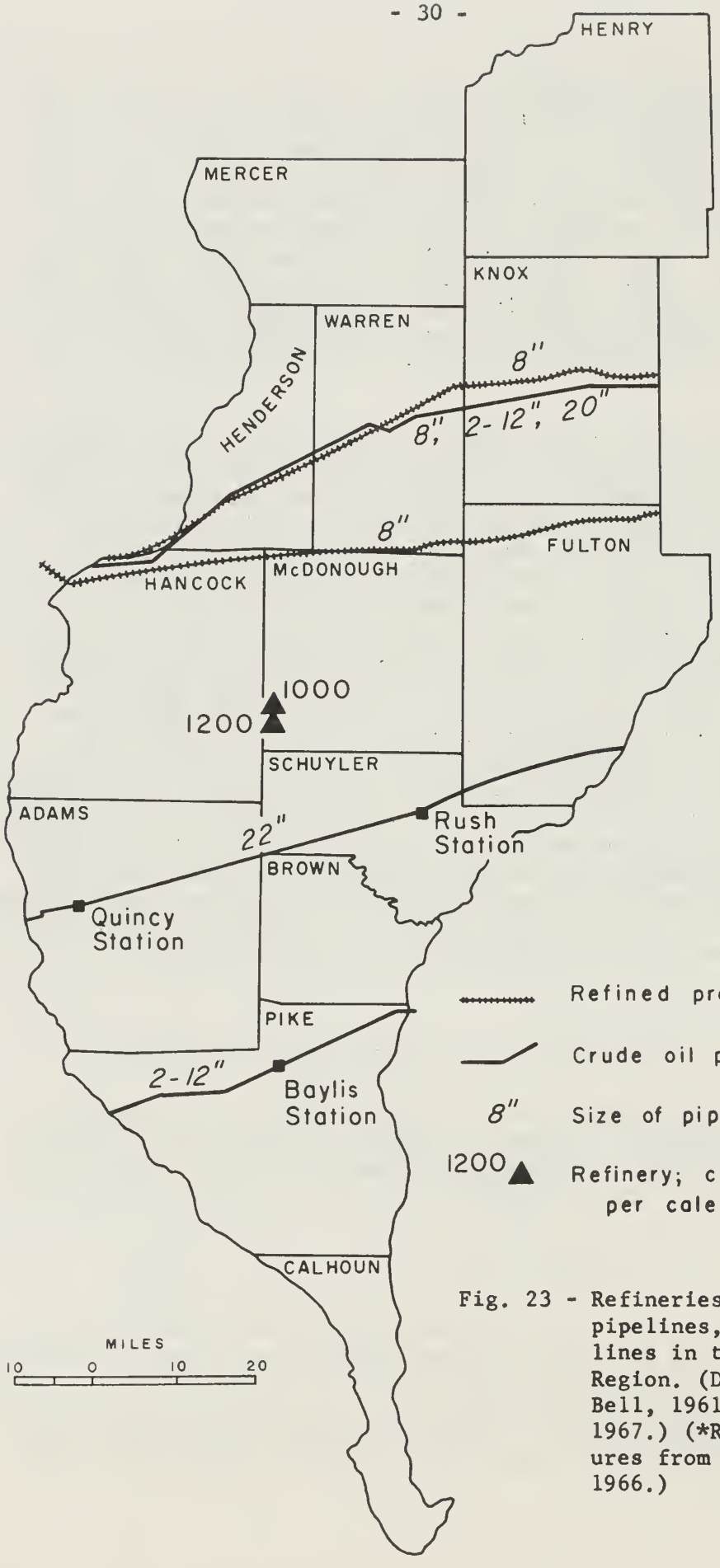

Fig. 23 - Refineries, refined products pipelines, and crude oil pipelines in the Western Illinois Region. (Data from Meents and Bell, 1961. Modified by Meents, 1967.) (*Refinery capacity figures from Oil and Gas Journal, 1966.)

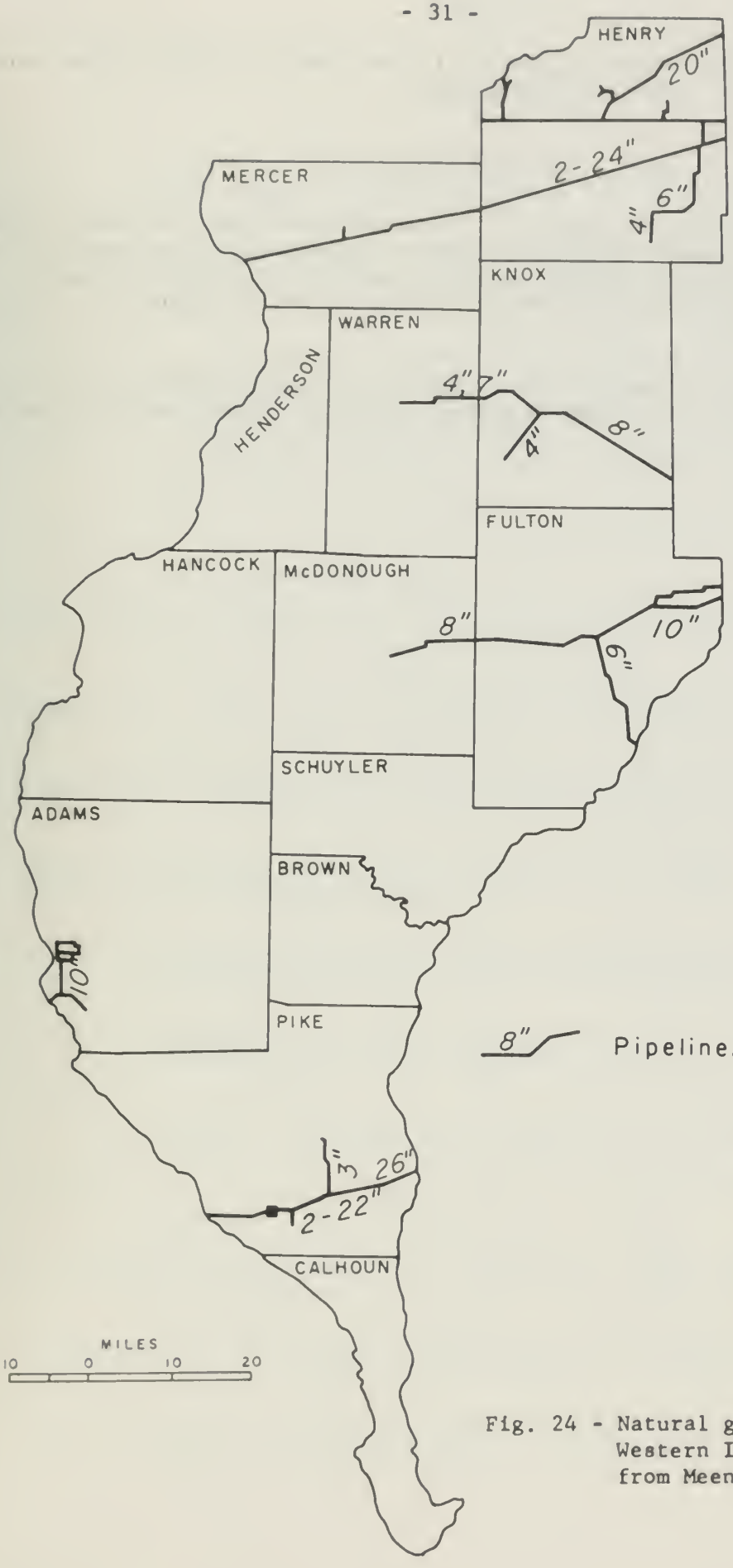

Fig. 24 - Natural gas pipelines in the Western Illinois Region. (Data from Meents and Bell, 1961.)

Menke Stone and Lime Company, located 3 miles south of Quincy, also produces high-calcium lime. (See fig. 13, p. 18.)

Oil and Gas

In addition to crude oil production operations, the Western Illinois Region has various petroleum transportation and processing facilities. Figure 23 indicates the location of the crude oil pipelines, refined products pipelines, and the location and capacity of petroleum refineries within the region.

Although no natural gas is being produced in the Western Illinois Region at present, several gas pipelines cross the region and are shown in figure 24.

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